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Chang

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(54) **FUNCTION EXPANSION ASSEMBLY AND ELECTRONIC DEVICE HAVING THE FUNCTION EXPANSION ASSEMBLY**

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G06F 1/16 (2006.01)
G06F 1/18 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 1/1658*** (2013.01); ***G06F 1/183*** (2013.01)

(58) **Field of Classification Search**
CPC H05K 7/00
See application file for complete search history.

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* cited by examiner

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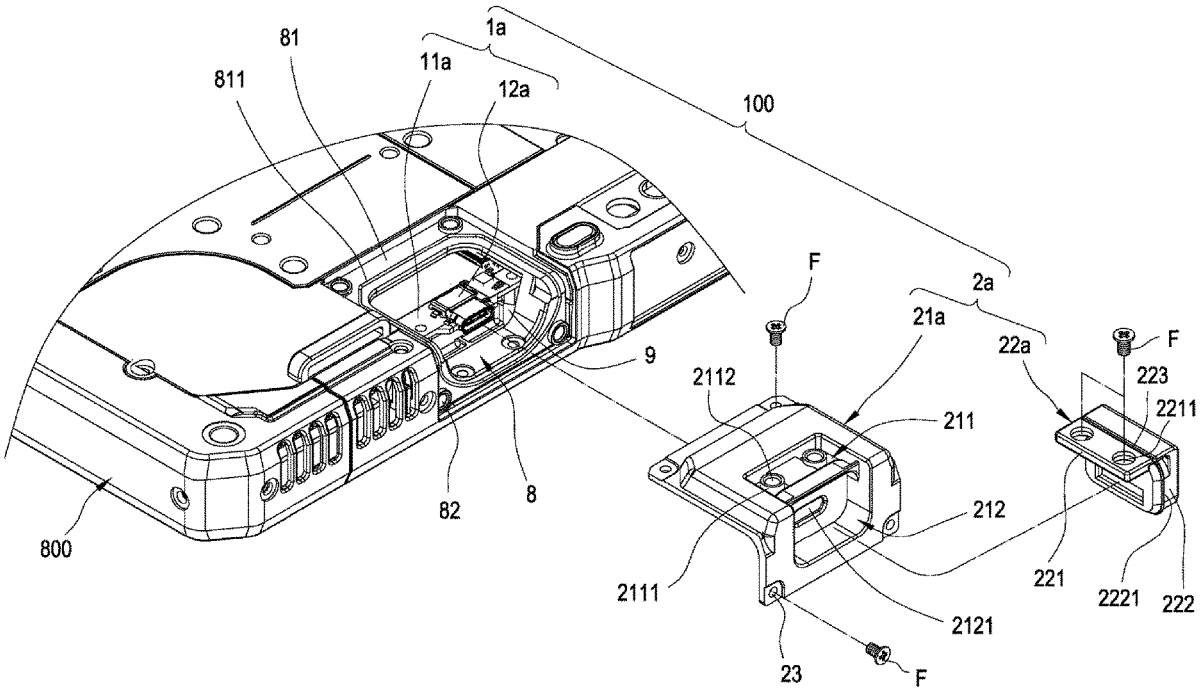
(57) **ABSTRACT**

An electronic device includes a frame, a covering structure and a functional module. The frame has an opening and a fixing portion corresponding to the opening. The covering structure and the functional module constitutes a function expansion assembly. The covering structure is used to be detachably fixed at the electronic device and to cover the opening. The functional module includes an expansion circuit board and an operation interface. The expansion circuit board is used to be detachably fixed at the fixing portion, and the operation interface is located corresponding in position to the opening. When the covering structure is detached from the electronic device, the operation interface is accessible through the opening.

9 Claims, 12 Drawing Sheets



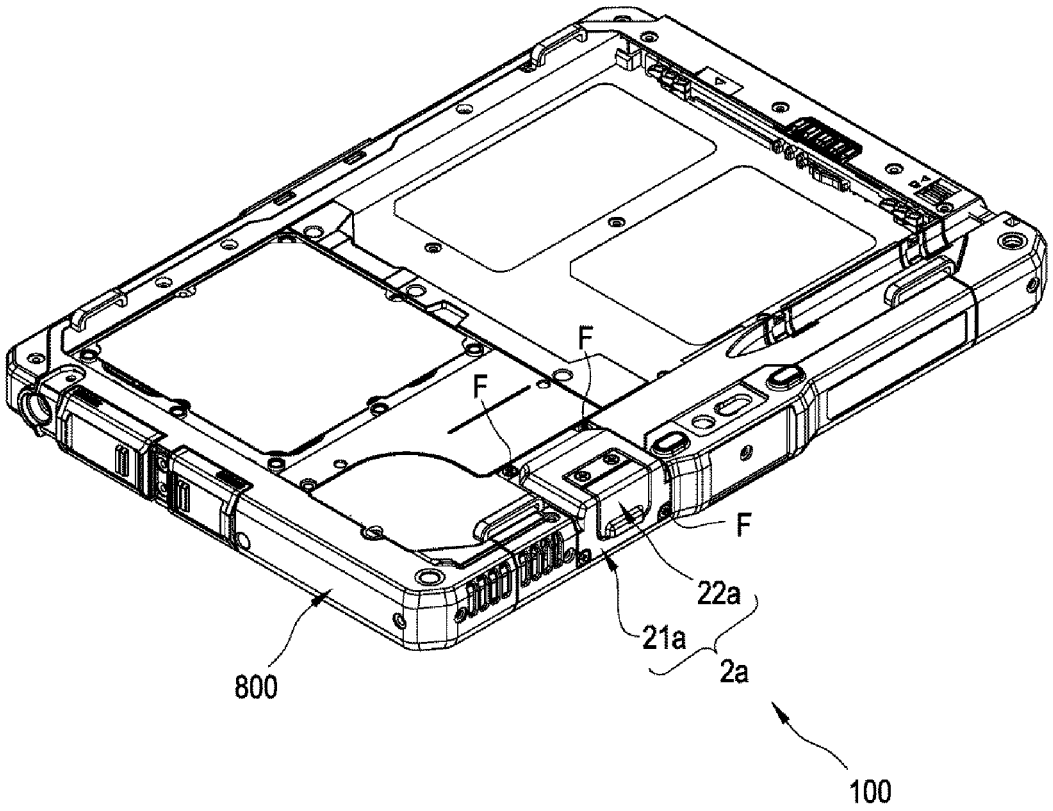
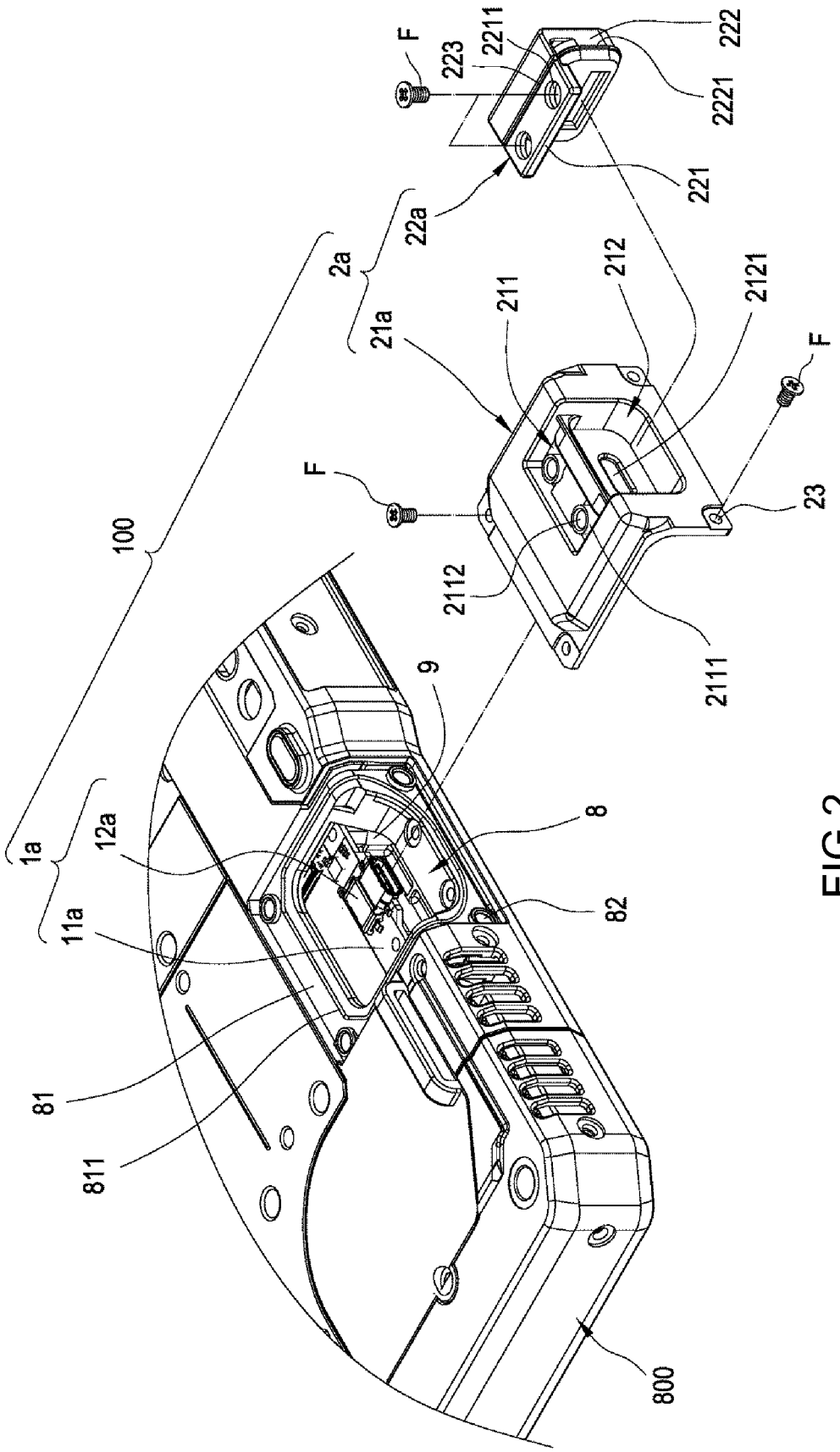


FIG.1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223
2211
222
2221
221
22a
2a
21a
211
212
2121
F
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23
2112
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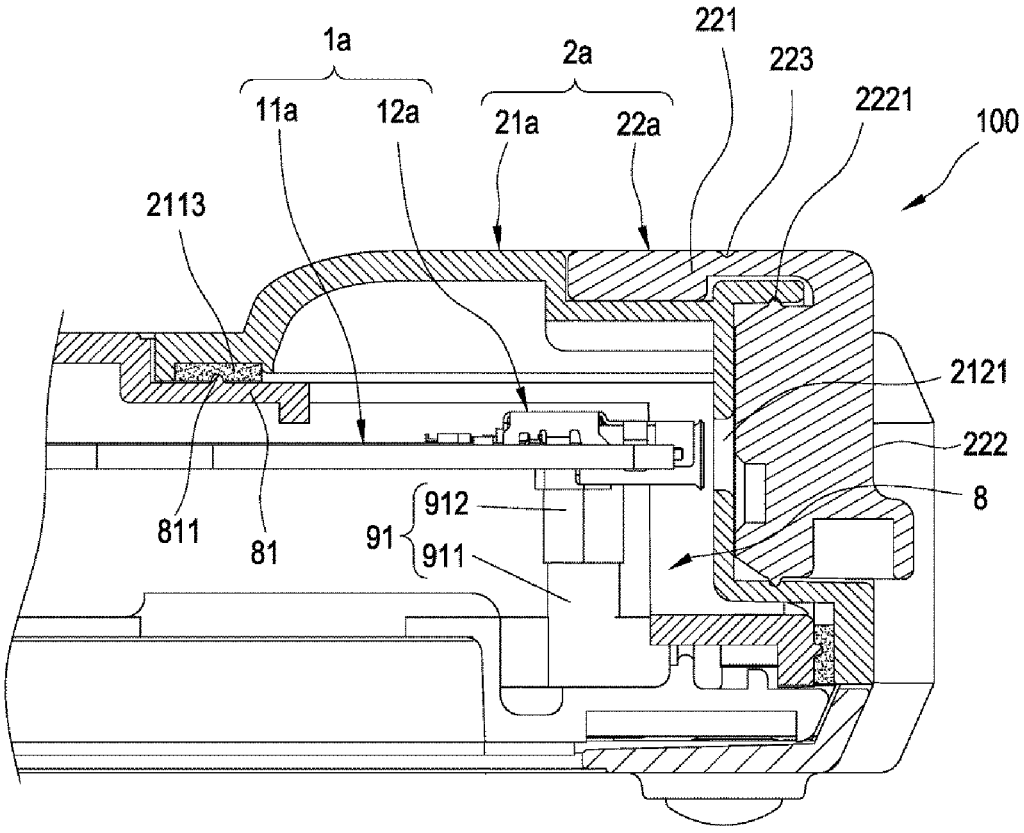
100
9
8
82
1a
12a
11a
81
811
800

FIG.2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11a
12a
2a
21a
22a
221
223
2221
100
2113
2121
222
8
912
91
911
811
81

FIG.3

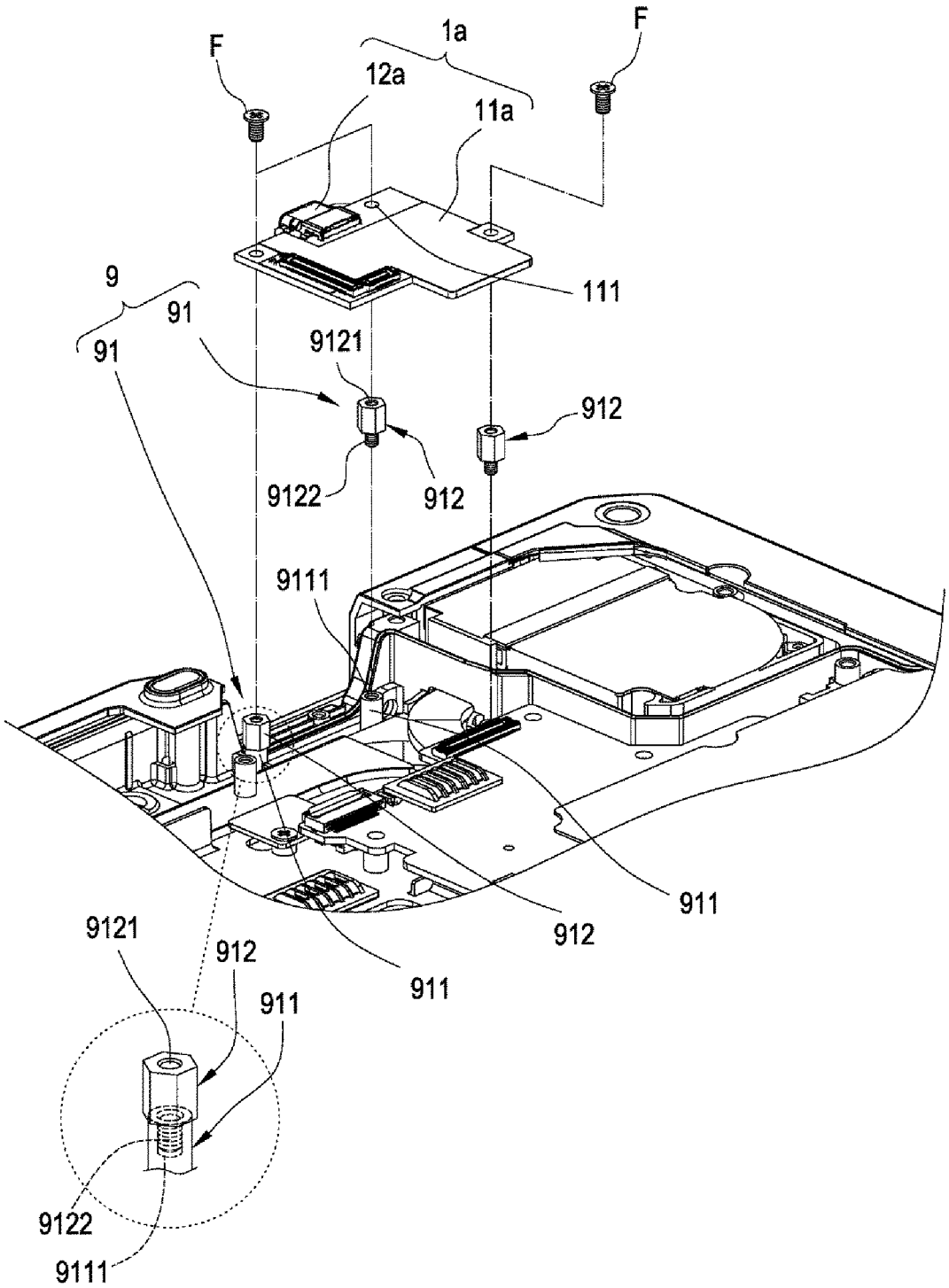
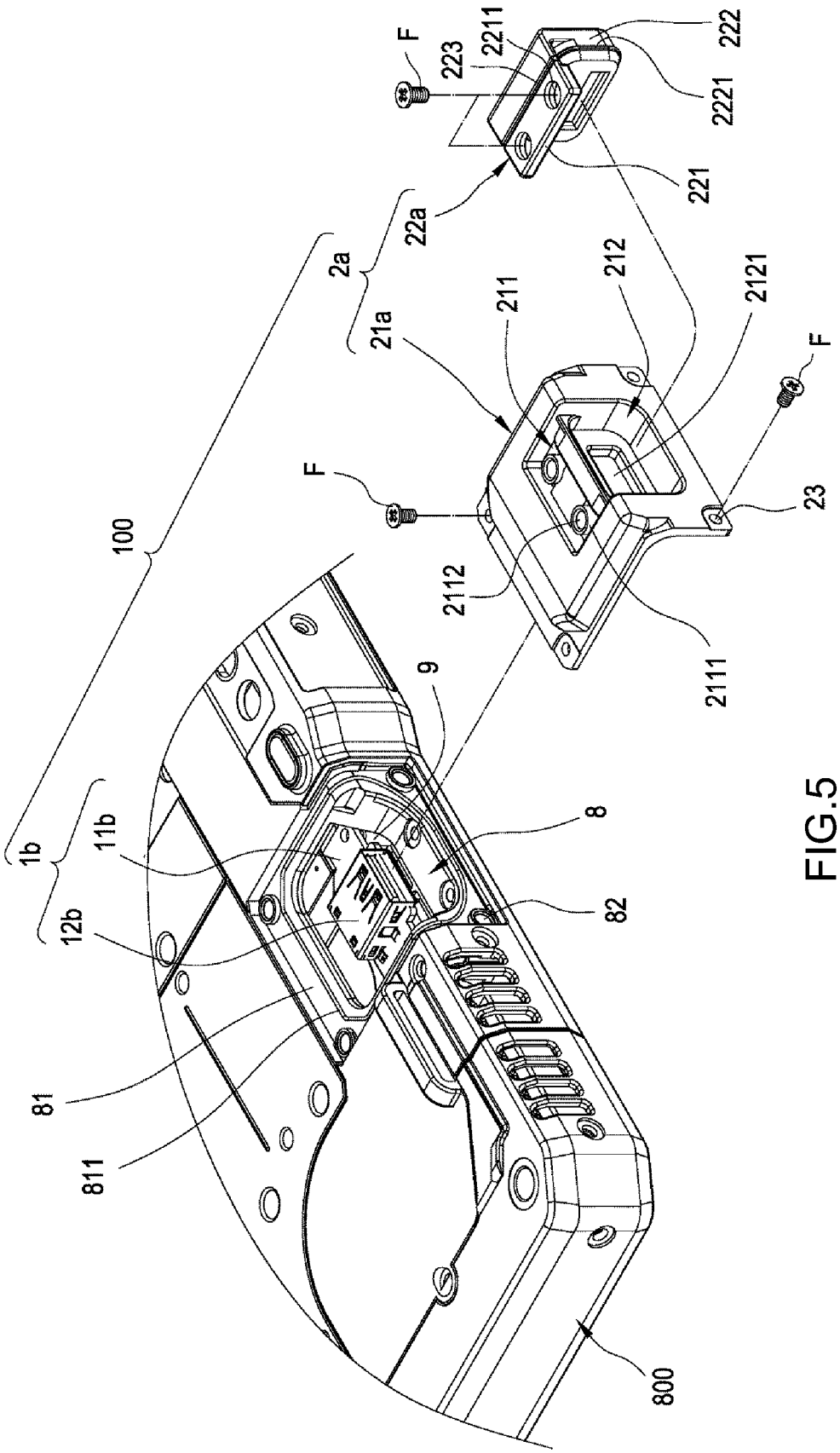

F
1a
F
12a
11a
111
9
91
91
9121
912
9122
912
9111
911
912
911
9121
912
911
9122
9111

FIG.4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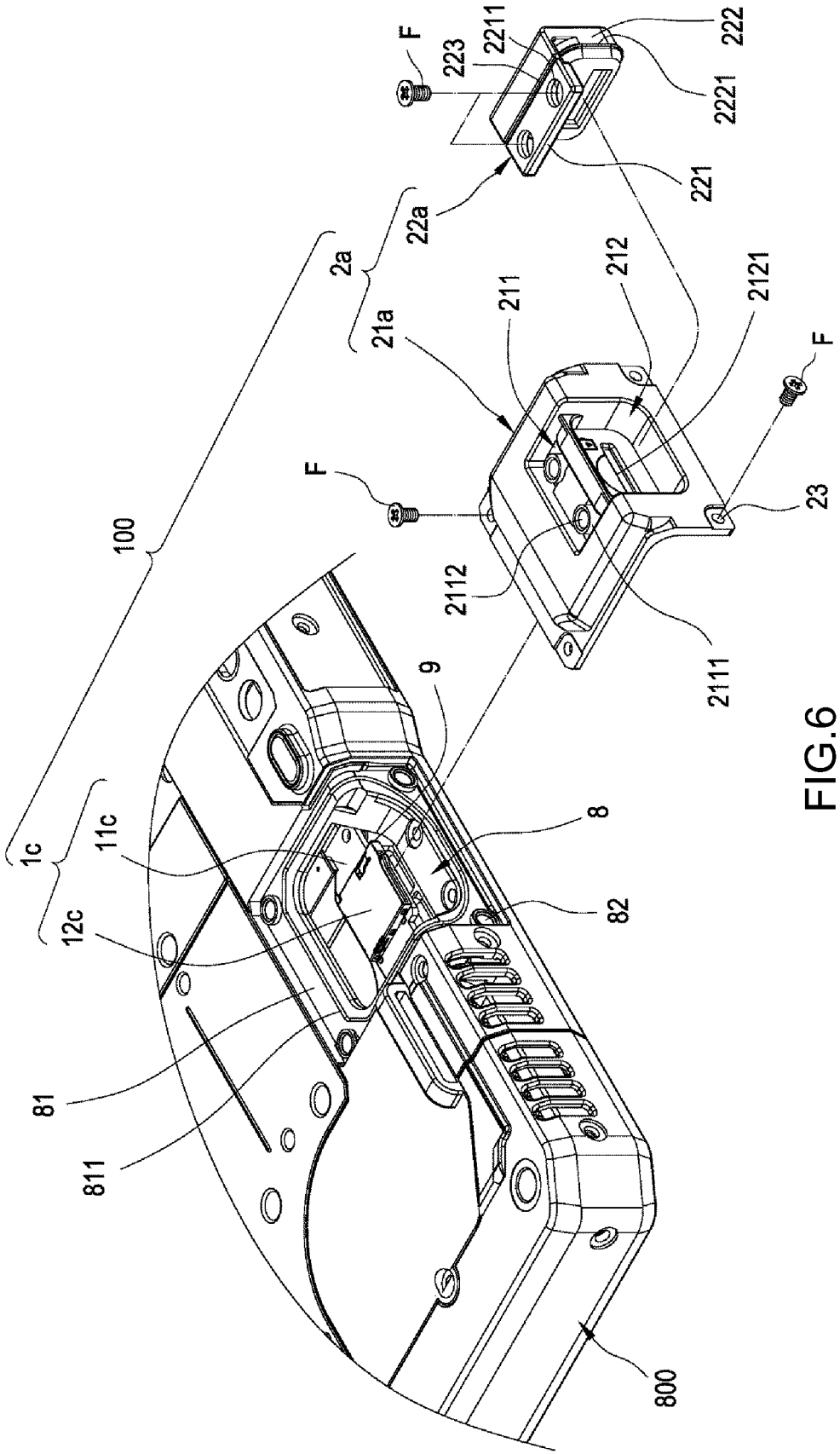
223
2211
222
2221
221
22a
2a
21a
211
212
2121
F
F
23
100
2112
2111
9
8
1b
11b
12b
82
81
811
800

FIG.5


F
223
2211
222
2221
221
22a
2a
21a
211
212
2121
F
F
23
100
2112
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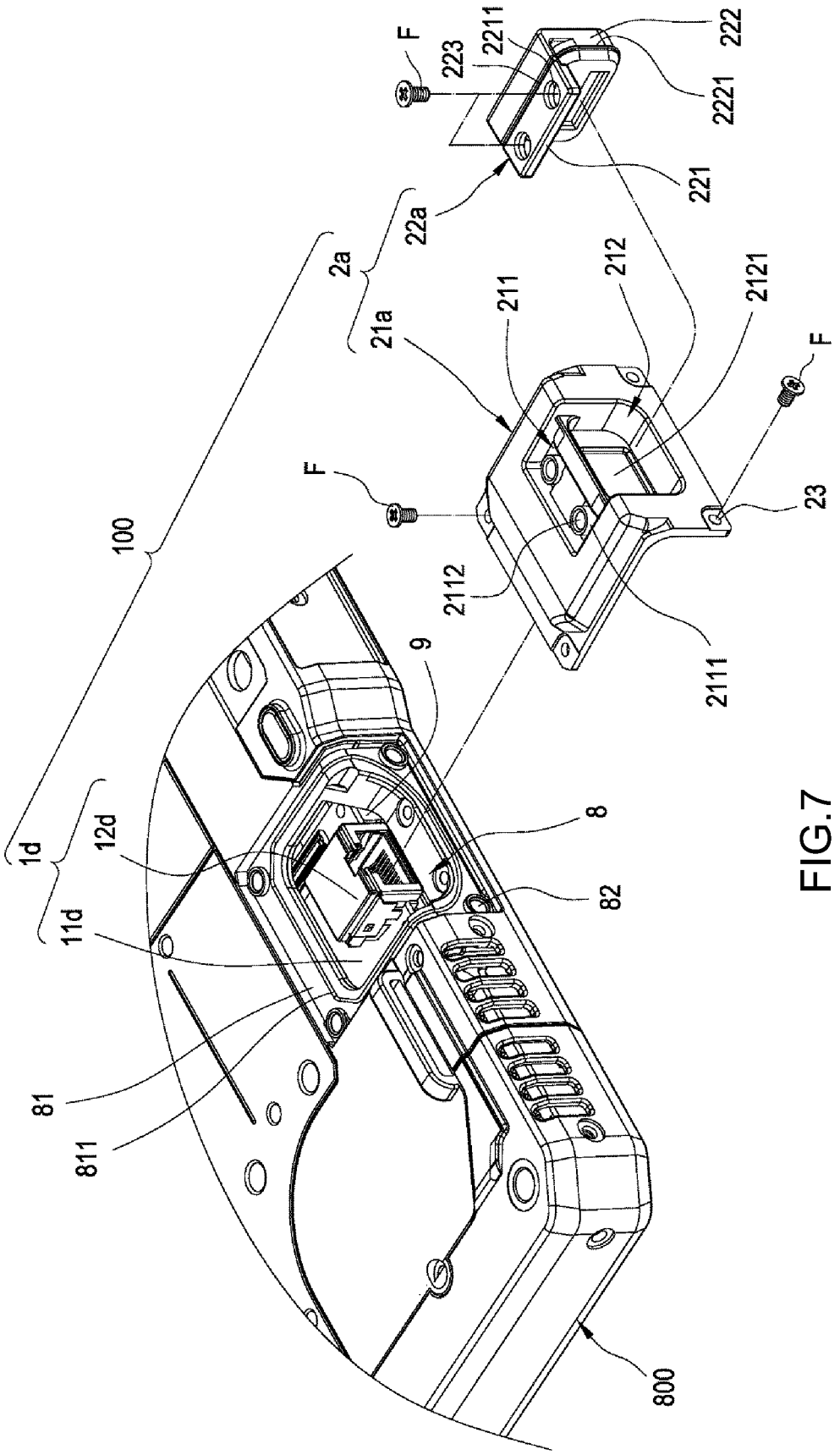
9
8
82
1c
11c
12c
81
811
800

FIG.6


F
223
2211
222
2221
221
22a
2a
21a
211
212
2121
F
F
23
100
2112
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9
1d
12d
11d
8
82
81
811
800

FIG.7

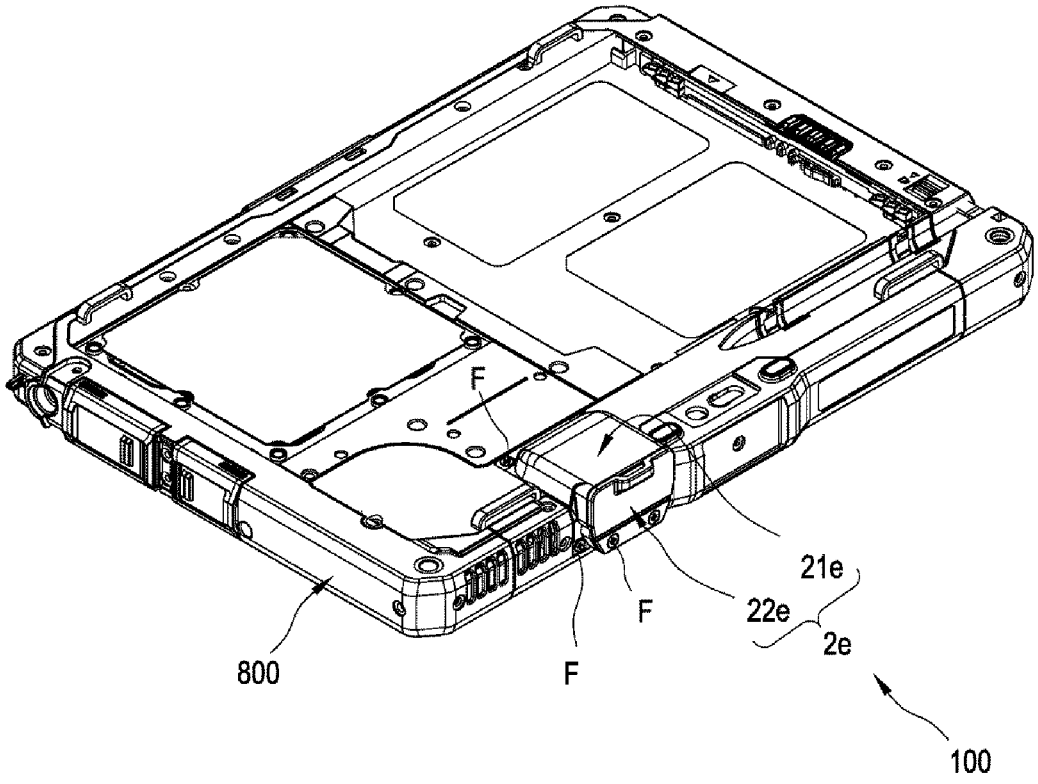

FIG.8

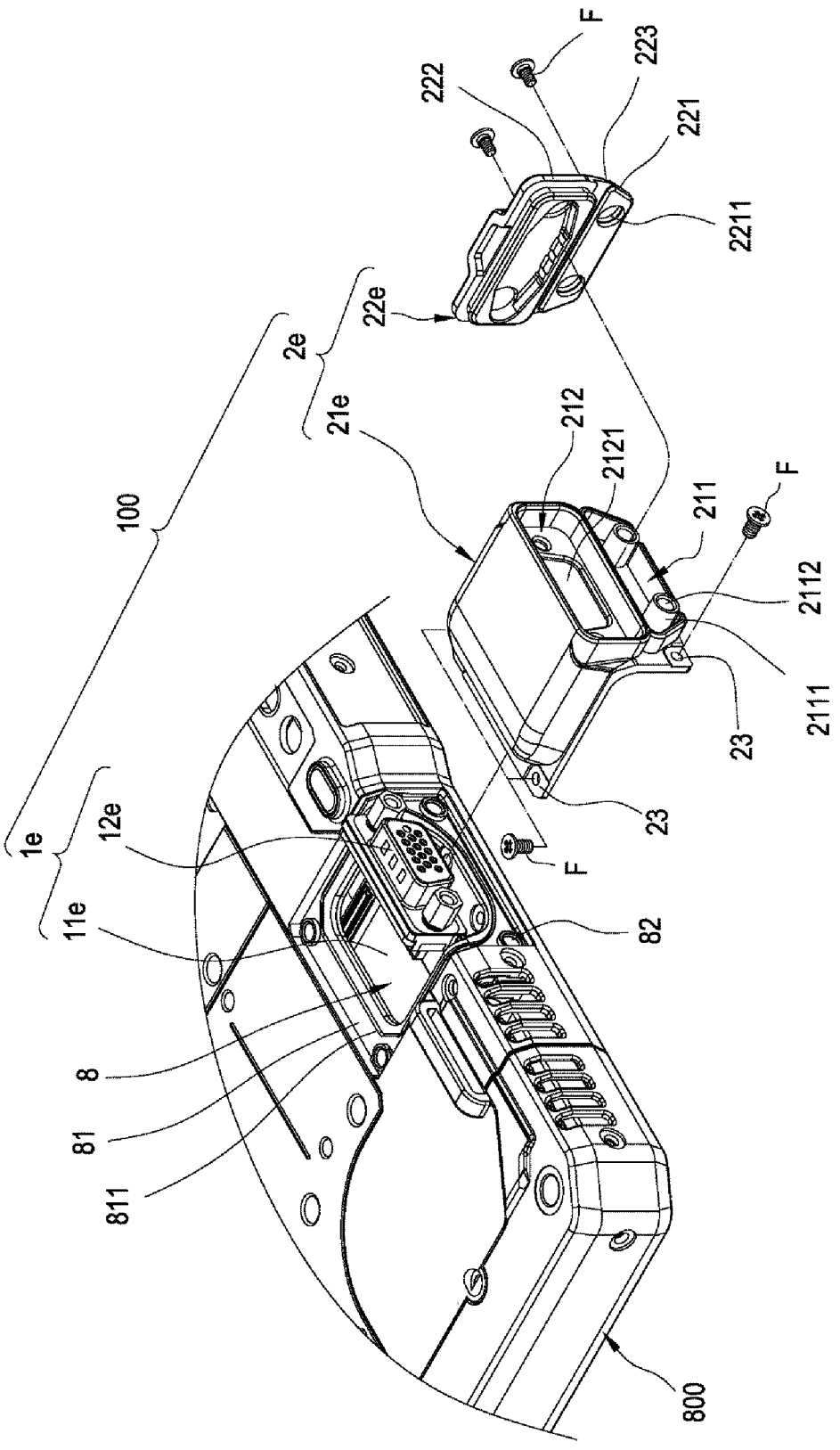
F
222
223
221
2211
22e
2e
21e
212
2121
211
F
100
2112
2111
23
23
1e
12e
F
11e
82
8
81
811
800

FIG.9

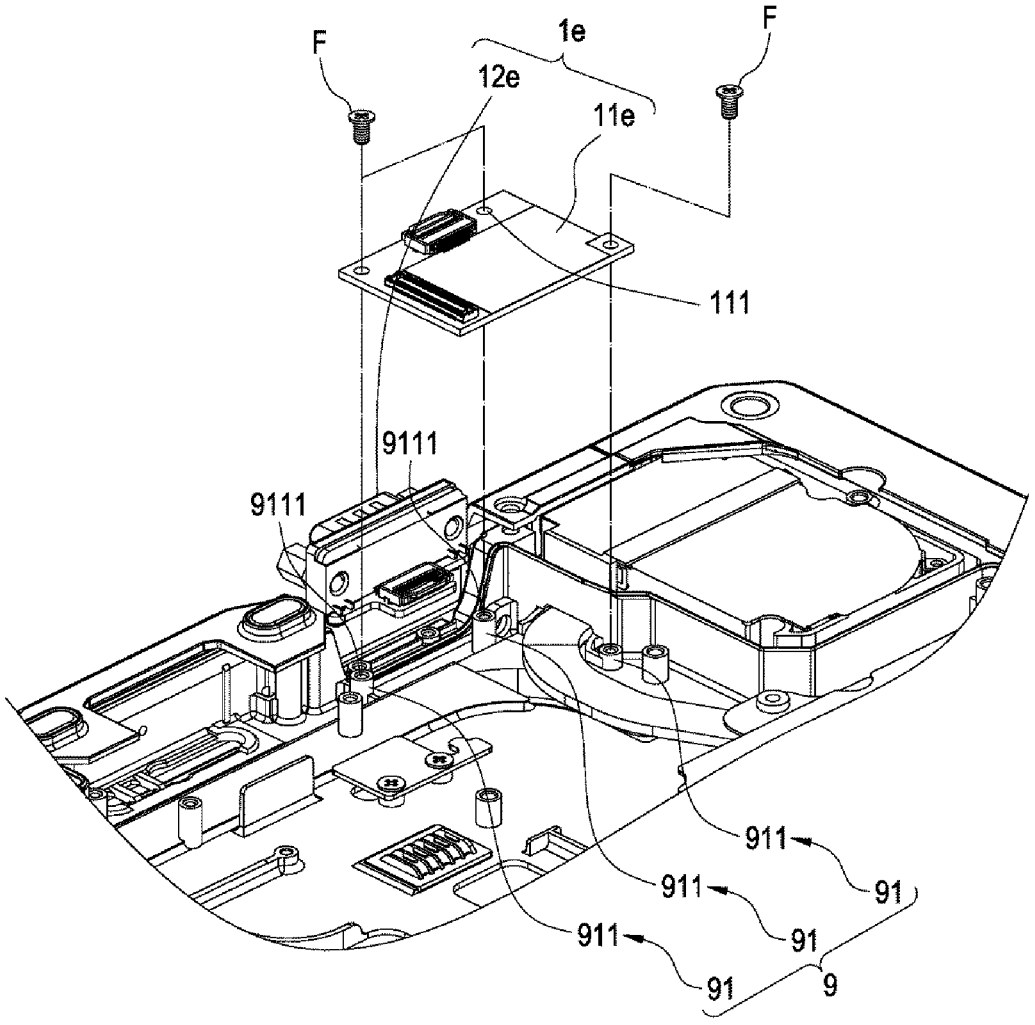

FIG.10

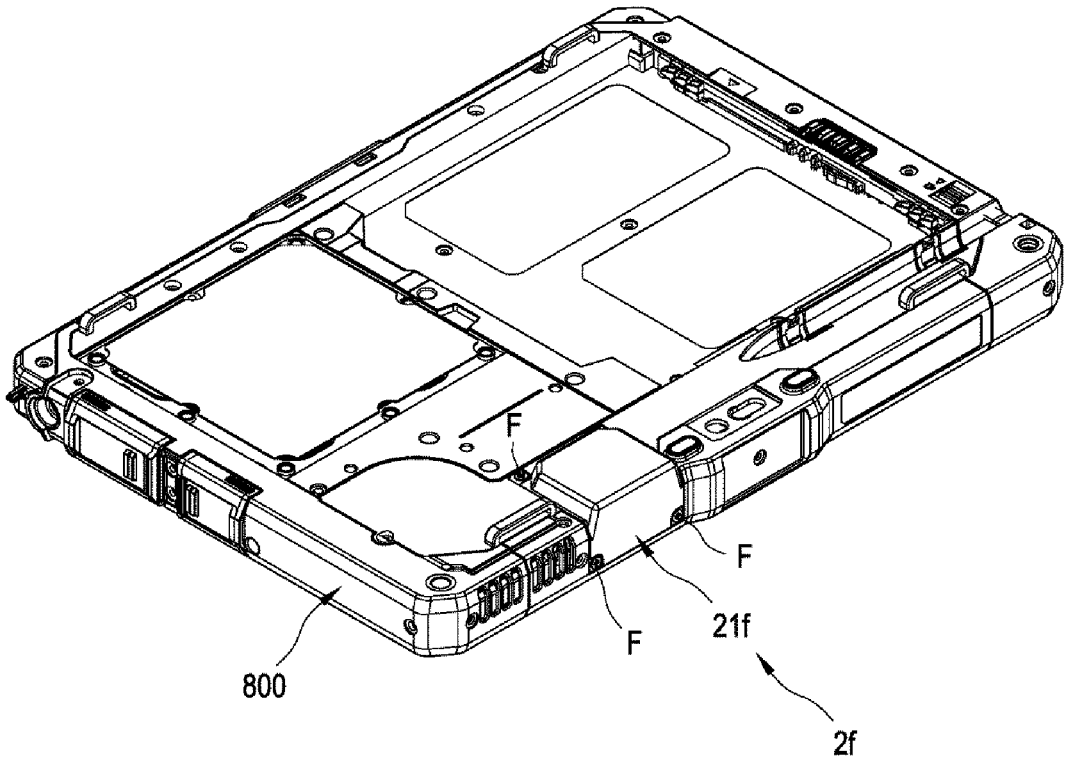

FIG.11

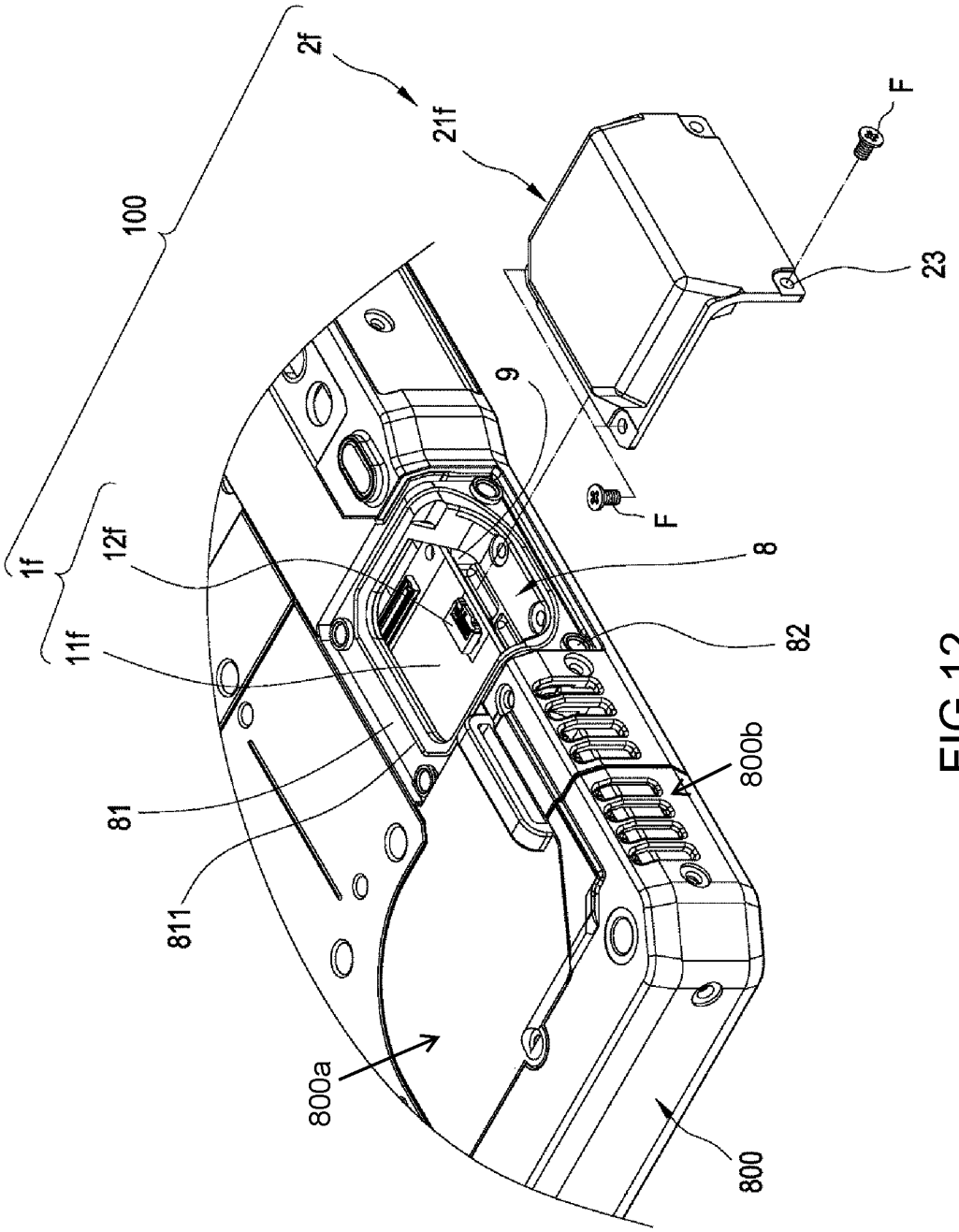

FIG.12

FUNCTION EXPANSION ASSEMBLY AND ELECTRONIC DEVICE HAVING THE FUNCTION EXPANSION ASSEMBLY

CROSS-REFERENCE TO RELATED PATENT APPLICATION

This non-provisional application is a Continuation application of U.S. patent application Ser. No. 16/995,009, now allowed, the disclosure of which is incorporated herein in its entirety by reference.

FIELD OF THE INVENTION

The present invention relates to function expansion technology of an electronic device, and more particularly to a function expansion assembly and an electronic device having the function expansion assembly.

BACKGROUND OF THE INVENTION

Current electronic devices are installed with as many as possible modules of diversified functions in order to provide diversified functions. These modules are, for example, a USB module, a USB type-C module, an SD card module and a LAN module.

However, current electronic devices are developed also in aim of being light in weight and small in size, leading to a limited remaining space for installing these modules. Therefore, different modules need to be installed in a manner of replacement according to requirements in a same remaining space, which however leads to issues of being susceptible to collision and hence damage of the modules due to such replacement.

In the above conditions, it is a critical task of the present invention as how to effectively replace a required module while providing an anti-collision effect after the replacement.

SUMMARY OF THE INVENTION

One aspect of the present invention relates to an electronic device, which includes: a frame having an opening and a fixing portion corresponding to the opening; a covering structure, configured to be detachably fixed at the electronic device and to cover the opening; and a functional module, comprising an expansion circuit board and an operation interface. The expansion circuit board is configured to be detachably fixed at the fixing portion, and the operation interface is located corresponding in position to the opening. When the covering structure is detached from the electronic device, the operation interface is accessible through the opening.

In certain embodiments, the frame has a corner defined by two adjacent sides, and the opening crosses the two adjacent sides at the corner.

In certain embodiments, the fixing portion comprises a plurality of fixing structures, each of the fixing structures is fixed on the frame and has a first fixing hole, the expansion circuit board is provided with a plurality of second fixing holes respectively corresponding to the plurality of first fixing holes, and the expansion circuit board is configured to be detachably fixed at the fixing portion by a fixing element fixed between each of the plurality of first fixing holes and each of the plurality of second fixing holes.

In certain embodiments, each of the fixing structures comprises a fixing column fixed on the frame, and the fixing column has the first fixing hole.

In certain embodiments, each of the fixing structures comprises a fixing column and a height padding column, the fixing column is fixed on the frame and has a counterpart fixing hole, the height padding column has the first fixing hole and a fixing member, the fixing structure is increased in height by fixing the fixing member to the counterpart fixing hole of the fixing column using the height padding column, and each of the fixing elements is detachably fixed between each of the plurality of second fixing holes of the expansion circuit board and the first fixing hole of each of the height padding column.

In certain embodiments, the frame comprises a flange formed correspondingly to the opening, the flange and the covering structure are respectively provided with a plurality of third fixing holes and a plurality of fourth fixing holes, and the covering structure is configured to be detachably fixed to the frame by a fixing element fixed between each of the plurality of third fixing holes and each of the plurality of fourth fixing holes.

In certain embodiments, the frame comprises a flange formed correspondingly to the opening, the flange and an inner side of the covering structure respectively comprise a rib and an elastic portion, both the flange and the rib are located to correspondingly surround the opening, and the elastic portion is fixed at the frame by the covering structure and is pressed by the rib to be correspondingly elastically recessed.

In another aspect of the present invention, a function expansion assembly is provided for function expansion of an electronic device. The electronic device includes a frame having an opening and a fixing portion corresponding to the opening. The function expansion assembly includes: a covering structure, configured to be detachably fixed at the electronic device and to cover the opening; and a functional module, comprising an expansion circuit board and an operation interface. The expansion circuit board is configured to be detachably fixed at the fixing portion, and the operation interface is located corresponding in position to the opening. When the covering structure is detached from the electronic device, the operation interface is accessible through the opening.

In certain embodiments, the frame has a corner defined by two adjacent sides, and the opening crosses the two adjacent sides at the corner.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a three-dimensional assembly diagram of an electronic device according to a first embodiment of the present invention;

FIG. **2** is an exploded three-dimensional diagram of an electronic device according to the first embodiment of the present invention;

FIG. **3** is a section diagram of an electronic device after assembly according to the first embodiment of the present invention;

FIG. **4** is an exploded three-dimensional diagram of a functional module in an electronic device according to the first embodiment of the present invention;

FIG. **5** is an exploded three-dimensional diagram of an electronic device according to a second embodiment of the present invention;

FIG. **6** is an exploded three-dimensional diagram of an electronic device according to a third embodiment of the present invention;

FIG. **7** is an exploded three-dimensional diagram of an electronic device according to a fourth embodiment of the present invention;

FIG. **8** is a three-dimensional assembly diagram of an electronic device according to a fifth embodiment of the present invention;

FIG. **9** is an exploded three-dimensional diagram of an electronic device according to the fifth embodiment of the present invention;

FIG. **10** is an exploded three-dimensional diagram of a functional module in an electronic device according to the fifth embodiment of the present invention;

FIG. **11** is a three-dimensional assembly diagram of an electronic device according to a sixth embodiment of the present invention; and

FIG. **12** is an exploded three-dimensional diagram of an electronic device according to the sixth embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Details and technical contents of the embodiment of the present invention are given with the accompanying drawings below. However, the accompanying drawings are for reference and illustration purposes and are not to be construed as limitations to the present invention.

The embodiment of the present invention provides a function expansion assembly and an electronic device having the function expansion assembly. FIG. **1** to FIG. **4** show an electronic device having a function expansion assembly (to be together referred to as an electronic device hereinafter) according to a first embodiment of the present invention. FIG. **5**, FIG. **6** and FIG. **7** show an electronic device according to second, third and fourth embodiments of the present invention. FIG. **8** to FIG. **10** show an electronic device according to a fifth embodiment of the present invention. FIG. **11** and FIG. **12** show an electronic device according to a sixth embodiment of the present invention.

As shown in FIG. **1** to FIG. **4**, an electronic device according to the first embodiment of the present invention includes a frame (a frame of the electronic device) **800** and a function expansion assembly **100**.

The frame **800** is provided with an opening **8**. The opening **8** crosses two adjacent sides of the frame **800**, and for example, crosses a large-area side (e.g., an obverse side or a reverse side) and a thickness side (e.g., one of the four lateral sides) of the frame **800**. The frame **800** is provided therein with a fixing portion **9** for fixing purposes, and the fixing portion **9** corresponds to the opening **8** so as to facilitate fixing through the opening **8**. As shown in FIG. **4**, the fixing portion **9** includes a plurality of fixing structures **91**, each of which is fixed in the frame **800** and has a first fixing hole **9121**.

The function expansion assembly **100** includes a functional module **1***a* and an anti-collision module **2***a*. The functional module **1***a* is for function expansion of the frame **800**, and the anti-collision module **2***a* is primarily for preventing the functional module **1***a* from receiving impact.

The functional module **1***a* may be various types of modules of required functions, and is exemplified by USB type-C for illustrations in this embodiment. The functional module **1***a* includes an expansion circuit board **11***a*, and an operation interface **12***a* disposed on the expansion circuit board **11***a*. As shown in FIG. **4**, the expansion circuit board **11***a* is provided with a plurality of second fixing holes **111** respectively corresponding to the first fixing holes **9121**.

For expansion, by disposing the expansion circuit **11***a* correspondingly to the fixing portion **9**, the first fixing holes **9121** and the second fixing holes **111** can be corresponded with each other. Next, by detachably fixing a fixing element F between each of the first fixing holes **9121** and each of the second fixing holes **111**, the functional module **1***a* can then be detachably fixed at the fixing portion **9** through the expansion circuit **11***a*. Thus, even if the available remaining space on the electronic device is limited, the object of function expansion can be similarly achieved by means of replacing different functional modules (e.g., **1***a*).

It should be noted that, functional modules **1***a* of different functions may have different height requirements with respect to the fixing portion **9**. Thus, when the functional module for expansion requires a lower height, the height of the fixing structure **91** does not need to be large, for example, a fixing column **911** is needed, with the fixing column **911** being fixed in the frame **800** and having the foregoing first fixing hole (not denoted by numerals). Conversely, if the functional module for expansion requires a larger height (e.g., the functional module **1***a* of this embodiment), the fixing structure **91** needs to further include a height padding column **912**, so as to serially connect the fixing column **911** and the height padding column **912** to increase the height.

In continuation of the above description, in the fixing structure **91** requiring additional height, the fixing column **911** is fixed in the frame **800** and has a counterpart fixing hole **9111**, and the height padding column **912** includes a fixing member **9122** and the foregoing first fixing hole **9121**. To increase the height of the fixing portion **9**, by detachably fixing and connecting the height padding columns **912** to the counterpart fixing holes **9111** of the fixing columns **911** by the fixing member **9122**, the fixing structures **91** can be provided with the required height by means of head-tail serial connection. In other words, the height padding columns **912** may have different lengths.

To fix the functional module **1***a* at a required height, in addition to adjusting the fixing structures **91** to the required height, the fixing elements F are further required to be respectively detachably fixed between the second fixing holes **111** of the expansion circuit board **11***a* and the first fixing holes (e.g., the first fixing holes **9121** of the height padding columns **912**) of the fixing structures **91**.

The anti-collision module **2***a* includes a covering structure **21***a* and a lid **22***a*. The covering structure **21***a* is for covering the opening **8** and is provided with an insertion slot **2121**. The insertion slot **2121** corresponds to a port (not denoted by numerals) of the operation interface **12***a*. The lid **22***a* is connected in a liftable and covering manner to the covering structure **21***a*, so as to expose the insertion slot **2121** when lifted open or to block the insertion slot **2121** when closed for covering.

The covering structure **21***a* has a shape corresponding to that of the opening **8**, and is formed as an L-shaped bend, and can thus completely cover the opening **8**. A flange **81** projects from an inner periphery of the frame **800** corresponding to the opening **8**, and surrounds correspondingly to the opening **8**. Hence, when the covering structure **21***a* covers correspondingly to the opening **8**, the covering structure **21***a* is blocked by the flange **81**. At this point, even if the anti-collision module **2***a* receives the impact of an external force, the covering structure **21***a* is, using the blocking of the flange **81**, prevented from being withdrawn inward toward the frame **800**, further avoiding issues of collision and

damage of the functional module **1***a* caused by inappropriate inward withdrawal of the covering structure **21***a*. Thus, in addition to preventing the functional module **1***a* from encountering direct impact, the anti-collision module **2***a* further prevents the functional module **1***a* from indirect impact of the covering structure **21***a*.

As shown in FIG. **2** and FIG. **3**, a rib **811** (or an elastic portion **2113**) may be further provided on an outer side of the flange **81**, and an elastic portion **2113** (or a rib **811**) may be further provided on an inner side of the covering structure **21***a*. The rib **811** also surrounds correspondingly to the opening **8**. In addition to being directly formed on the inner side (or the outer side of the flange **81**) of the covering structure **21***a*, the elastic portion **2113** may be an elastic lining or a waterproof foam sponge additional provided, as shown in the drawings; however, the present invention is not limited to the above examples. The flange **81** and the covering structure **21***a* are provided with a plurality of third fixing holes **82** and a plurality of fourth fixing holes **23** corresponding to each other, respectively. By respectively fixing the plurality of fixing elements F between the third fixing holes **82** and the fourth fixing holes **23**, the covering structure **21***a* may be detachably fixed to the flange **81** in a manner of corresponding to the opening **8**. Thus, when the covering structure **21***a* is fixed at the flange **81** by the fixing elements F, the elastic portion **2113** is pressed by the rib **811** and correspondingly becomes elastically recessed (see FIG. **3**) to further provide better waterproofness, such that the anti-collision module **2***a* further provides waterproof and dustproof effects, while providing an effect of enabling the covering structure **21***a* to be stably coupled to the frame **800**.

The lid **22***a* has a shape corresponding to that of the covering structure **21***a*, and is also formed as an L-shaped bend (as shown in FIG. **2** and FIG. **3**). The lid **22***a* includes a fixing plate **221**, a movable plate **222**, and a bending portion **223** connected between the fixed plate **221** and the movable plate **222**. The covering structure **21***a* further includes a first recess **211** and a second recess **212** adjacent to each other. The first recess **211** and the second recess **212** are both recessed from the opening **8** toward the interior of the frame **800**. The first recess **211** is provided therein with a plurality of (at least two) in-recess fixing columns **2111**, each of the in-recess fixing columns **2111** is provided with a fifth fixing hole **2112**, and the second recess **212** is provided therein with the foregoing insertion slot **2121**.

The fixing plate **221** is provided with a plurality of sixth fixing holes **2211**. By correspondingly embedding the fixing plate **221** in the first recess **211**, the fifth fixing holes **2112** and the sixth fixing holes **2211** may be respectively corresponded to each other, thus facilitating the plurality of fixing elements F to be respectively detachably fixed between the fifth fixing holes **2112** and the sixth fixing holes **2211**, enabling the fixing plate **211** to be detachably fixed in the first recess **211** of the covering structure **21***a*. It should be noted that, even if the covering structure **21***a* has a small thickness, the fixing elements F can be provided with a longer fixing length using the in-recess fixing columns **2111**, further providing a stable coupling effect.

The movable plate **222** can bend relative to the fixing plate **221** through the bending portion **223**, for example, to be lifted open or closed by bending, and can be embedded in the second recess **212** when the covering the insertion opening **2121**. As shown in FIG. **2** and FIG. **3**, a peripheral rib **2221** projects from an outer periphery of the movable plate **222**. When the movable plate **222** is correspondingly embedded in the second recess **212**, the peripheral rib **2221** can be abutted against an inner periphery of the second recess **212**, hence producing waterproof and dustproof effects for the insertion slot **2121** between the movable plate **222** and the second recess **212**.

FIG. **5**, FIG. **6** and FIG. **7** show an electronic device according to the second, third and fourth embodiments of the present invention. The second, third and fourth embodiments are substantially the same with the first embodiment, and differ merely in that different functional modules **1***b*, **1***c* and **1***d* are selected in the second, third and fourth embodiments. The functional modules **1***b*, **1***c* and **1***d* comprise respective expansion circuit boards **11***b*, **11***c* and **11***d*, and respective operation interfaces **12***b*, **12***c* and **12***d*.

The functional modules **1***b*, **1***c* and **1***d* are respectively exemplified by USB, an SD card and LAN in the second, third and fourth embodiments, and may thus respectively include the operation interfaces **12***b*, **12***c* and **12***d* that are respectively a USB connector, a card connector and a network connector.

The anti-collision module **2***a* of the first embodiment is used in continuation, given that the height (not shown) of the fixing structures **91** is correspondingly adjusted with respect to different height requirements. Although the anti-collision module **2***a* of the first embodiment is used in the second, third and fourth embodiments, due to different shapes of the ports (not denoted by numerals) of the operation interfaces **12***b*, **12***c* and **12***d*, the insertion slot **2121** of the covering structure **21***a* in the second, third and fourth embodiments also needs to be in corresponding shapes.

FIG. **8** to FIG. **10** show an electronic device according to the fifth embodiment of the present invention. The fifth embodiment is substantially the same with the first embodiment, and differs merely in that the function expansion assembly **100** selected in the fifth embodiment is different from that in the first embodiment. In the fifth embodiment, the function expansion assembly **100** includes a functional module **1***e* and an anti-collision module **2***e*.

The functional module **1***e* is exemplified by VGA in the fifth embodiment for illustration purposes, and thus includes an expansion circuit board **11***e* and an operation interface **12***e* that may be a VGA connector and electrically connected to the expansion circuit board **11***e*. As the functional module **1***e* requires a smaller height, each of the fixing structures **91** includes only one fixing column **911**, and each fixing column **911** is fixed in the frame **800** and has a first fixing hole **9111**. To fix the functional module **1***e* at a required height, the fixing elements F may be directly detachably fixed between the second fixing holes **111** of the expansion circuit board **11***e* and the first fixing holes **9111** of the fixing structures **91**, respectively.

The anti-collision module **2***e* is substantially the same with that of the first embodiment, and differs merely by corresponding changes made to adapt to the different functional module **1***e*. The anti-collision module **2***e* includes a covering structure **21***e* and a lid **22***e*. Although the covering structure **21***e* is also formed as an L-shaped bend and has a second surface portion (not denoted by numerals), in order adapt to the functional module **1***e*, the first recess **211** and the second recess **212** are disposed side by side on the same surface portion (a lower surface portion in FIG. **9**) of the L-shaped bend. In contrast, in this first embodiment, the first recess **211** and the second recess **212** are respectively disposed on two surface portions of the L-shaped bend.

The lid **22***e* is substantially the same with that of the first embodiment, and differs merely by corresponding changes made to adapt to the different covering structure **21***e*. The lid **22***e* has a shape corresponding to the lower surface portion of the covering structure **21***e* and is formed as a plane in

shape. The lid **22***e* similarly includes a fixing plate **221**, a movable plate **222**, and a bending portion **223** connected between the fixing plate **221** and the movable plate **222**. The fixing plate **221** is detachably fixed in the first recess **211** of the covering structure **21***e*. The movable plate **222** can bend relative to the fixing plate **221** through the bending portion **223**, for example, to be lifted open or closed by bending, and be embedded in the second recess **212** when the covering the insertion opening **2121**.

FIG. **11** and FIG. **12** show an electronic device according to the sixth embodiment of the present invention. The sixth embodiment is substantially the same with the first embodiment, and differs merely in that the function expansion assembly **100** selected in the sixth embodiment is different from that in the first embodiment. In the sixth embodiment, the frame **800** has a corner defined by two adjacent sides **800***a* and **800***b*, and the opening **8** crosses the two adjacent sides **800***a* and **800***b* at the corner.

The function expansion assembly **100** includes a functional module **1***f* and a detachable module **2***f*. The functional module **1***f* is exemplified by RFID in the sixth embodiment for illustrations, and thus includes an expansion circuit board **11***f* and an operation interface **12***f* that may be an RFID connector. The expansion circuit board **11***f* may be detachably fixed at the fixing portion (not shown in FIG. **11**), and the operation interface **12***f* is located corresponding in position to the opening **8**.

The detachable module **2***f* is similar to the anti-collision module **2***a* in the first embodiment in terms of only the L-shaped bend, and does not include the lid but only includes only the covering structure **21***f* that is similarly an L-shaped bend because no other external electronic product needs to be additionally plugged. The covering structure **21***f* is detachably fixed at the electronic device to cover the opening **8**. An antenna (not shown) is fixedly provided on an inner surface of the covering structure **21***f*, such that the antenna can be plugged to the operation interface **12***f* by a plug (not shown).

Although FIG. **11** and FIG. **12** only show the fixing portion **9** without showing the detailed structure thereof, the structure of the fixing portion **9** may be similar to the first embodiment. For example, in certain embodiments, the fixing portion **9** may include a plurality of fixing structures **91** (see FIG. **4**), each of which is fixed on the frame **800** and has a first fixing hole **9121**. Similarly, the expansion circuit board **11***f* may be similar to the expansion circuit board **11***a* in the first embodiment, which may be provided with a plurality of second fixing holes **111** (see FIG. **4**) respectively corresponding to the first fixing holes **9121**. By disposing the expansion circuit **11***f* correspondingly to the fixing portion **9**, the first fixing holes **9121** and the second fixing holes **111** can be corresponded with each other. Thus, the expansion circuit board **11***f* may be detachably fixed at the fixing portion **9** by a fixing element F fixed between each of the first fixing holes **9121** and each of the second fixing holes **111**.

In certain embodiments, each of the fixing structures **91** may include a fixing column **911** (see FIG. **4**) fixed on the frame **800**, and the fixing column **911** has the first fixing hole **9121**. Alternatively, in certain embodiments, each of the fixing structures **91** may include a fixing column **911** and a height padding column **912** (see FIG. **4**), the fixing column **911** is fixed on the frame **800** and has a counterpart fixing hole **9111**, the height padding column **912** has the first fixing hole **9121** and a fixing member **9122**, such that the fixing structure **91** is increased in height by fixing the fixing member **9122** to the counterpart fixing hole **9111** of the fixing column **911** using the height padding column **912**, and each of the fixing elements F is detachably fixed between each of the second fixing holes **111** of the expansion circuit board **11***f* and the first fixing hole **9121** of each of the height padding column **912**.

In certain embodiments, the frame **800** includes a flange **81** formed correspondingly to the opening **8**, such that when the covering structure **21***f* covers correspondingly to the opening **8**, the covering structure **21***f* is blocked by the flange **81**. The flange **81** and the covering structure **21***f* are respectively provided with a plurality of third fixing holes **82** and a plurality of fourth fixing holes **23**, and the covering structure **21***f* is configured to be detachably fixed to the frame **800** by a fixing element F fixed between each of the third fixing holes **82** and each of the plurality of fourth fixing holes **23**. In certain embodiments, the flange **81** has a rib **811**, and an inner side of the covering structure **21***f* may include an elastic portion **2113** (see FIG. **3**). Both the flange **81** and the rib **811** are located to correspondingly surround the opening **8**, and the elastic portion **2113** is fixed at the frame **800** by the covering structure **21***f* and is pressed by the rib **811** to be correspondingly elastically recessed.

Accordingly, the opening **8** provided at the frame **800** of the embodiment of the present invention, in addition to facilitating replacement of the functional modules **1***a*, **1***b*, **1***c*, **1***d*, **1***e* and **1***f* using the part on the large-area side of the frame **800**, further allows an external electronic product (not shown) to be readily plugged using the part on the thickness side of the frame **800**, and even enables the anti-collision modules **2***a*, **2***e* and **2***f* to provide, by the flange **81** projecting from the inner periphery of the opening **8**, an effect of preventing the functional modules from impact or collision, preferably, as well as waterproof and dustproof effects. Further, since the function expansion assembly **100** is a discrete structure of a detachable assembly, the combination thereof can be freely changed according to requirements. Moreover, the height of the fixing structures **91** can be easily adjusted with respect to different height requirements because the fixing portion **9** is disposed at a position corresponding to the opening **8**.

The electronic device in the foregoing embodiments is, for example, a display, a tablet computer or a laptop computer; however, the present invention is not limited thereto.

In conclusion, the function expansion assembly and the electronic device having the function expansion assembly in the foregoing embodiments are capable of achieving expected application objects, and resolve drawbacks of the prior art. Therefore, the embodiment of the present invention fully meets patentable requirements, and an application for a patent is filed accordingly. Granting of patent rights is respectfully requested so as to ensure the rights of the inventor.

The above descriptions are at least one of feasible embodiments of the present invention, and are not to be construed as limitations to the present invention. Equivalent structural changes made on the basis of the description and drawings of the present invention should therefore be encompassed with the scope of the appended claims of the present invention.

What is claimed is:

1. An electronic device, comprising: a frame having an observe side and a reverse side opposite to each other, a plurality of lateral sides adjacent to the observe side and the reverse side, an opening and a fixing portion corresponding to the opening, wherein the opening crosses the reverse side and one of the lateral sides; a covering structure comprising a lid configured to cover a slot, the covering structure

configured to be detachably fixed at the electronic device and to completely cover the opening; and a functional module, comprising an expansion circuit board and an operation interface with a connector, the slot is positioned to align with the connector and allowed an external electronic connector to connect therethrough wherein the expansion circuit board is configured to be detachably fixed at the fixing portion, and the operation interface is located corresponding in position to the opening, wherein when the covering structure is detached from the electronic device, the expansion circuit board is configure to be detached through the opening.

2. The electronic device according to claim **1**, wherein the frame has a corner defined by the reverse side and the one of the lateral sides, and the opening crosses the reverse side and the one of the lateral sides at the corner.

3. The electronic device according to claim **1**, wherein the fixing portion comprises a plurality of fixing structures, each of the fixing structures is fixed on the frame and has a first fixing hole, the expansion circuit board is provided with a plurality of second fixing holes respectively corresponding to the plurality of first fixing holes, and the expansion circuit board is configured to be detachably fixed at the fixing portion by a fixing element fixed between each of the plurality of first fixing holes and each of the plurality of second fixing holes.

4. The electronic device according to claim **3**, wherein each of the fixing structures comprises a fixing column fixed on the frame, and the fixing column has the first fixing hole.

5. The electronic device according to claim **3**, wherein each of the fixing structures comprises a fixing column and a height padding column, the fixing column is fixed on the frame and has a counterpart fixing hole, the height padding column has the first fixing hole and a fixing member, the fixing structure is increased in height by fixing the fixing member to the counterpart fixing hole of the fixing column using the height padding column, and each of the fixing elements is detachably fixed between each of the plurality of second fixing holes of the expansion circuit board and the first fixing hole of each of the height padding column.

6. The electronic device according to claim **1**, wherein the frame comprises a flange formed correspondingly to the opening, the flange and the covering structure are respectively provided with a plurality of third fixing holes and a plurality of fourth fixing holes, and the covering structure is configured to be detachably fixed to the frame by a fixing element fixed between each of the plurality of third fixing holes and each of the plurality of fourth fixing holes.

7. The electronic device according to claim **1**, wherein the frame comprises a flange formed correspondingly to the opening, the flange and an inner side of the covering structure respectively comprise a rib and an elastic portion, both the flange and the rib are located to correspondingly surround the opening, and the elastic portion is fixed at the frame by the covering structure and is pressed by the rib to be correspondingly elastically recessed.

8. A function expansion assembly for function expansion of an electronic device, the electronic device comprising a frame having an opening and a fixing portion corresponding to the opening, the function expansion assembly comprising: a covering structure comprising a lid configured to cover a slot, the covering structure configured to be detachably fixed at the electronic device and to completely cover the opening; and a functional module, comprising an expansion circuit board and an operation interface with a connector, the slot is positioned to align with the connector and allowed an external electronic connector to connect therethrough, wherein the expansion circuit board is configured to be detachably fixed at the fixing portion, and the operation interface is located corresponding in position to the opening, wherein the frame has an observe side and a reverse side opposite to each other and a plurality of lateral sides adjacent to the observe side and the reverse side, and the opening crosses the reverse side and one of the lateral sides; and wherein when the covering structure is detached from the electronic device, the expansion circuit board is configure to be detached through the opening.

9. The function expansion assembly according to claim **8**, wherein the frame has a corner defined by the reverse side and the one of the lateral sides, and the opening crosses the reverse side and the one of the lateral sides at the corner.

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